

NASA MSFC Electrostatic Levitator (ESL) Rapid Quench System

Electrostatic levitation, a form of containerless processing, is an important tool in materials research. Levitated specimens are free from contact with a container; therefore, heterogeneous nucleation on container walls is not possible. This allows studies of deeply undercooled melts. Furthermore, studies of high-temperature, highly reactive materials are also possible. Studies of the solidification and crystallization of undercooled melts is vital to the understanding of microstructure development, particularly the formation of alloys with unique properties by rapid solidification.

The NASA Marshall Space Flight Center (MSFC) Electrostatic Levitator (ESL) lab has recently been upgraded to allow for rapid quenching of levitated materials. The ESL Rapid Quench System uses a small crucible-like vessel that can be partially filled with a low melting point material, such as a Gallium alloy, as a quench medium. An undercooled sample can be dropped into the vessel to rapidly quench the sample. A carousel with nine vessels sits below the bottom electrode assembly. This system allows up to nine rapid quenches before having to break vacuum and remove the vessels. This new Rapid Quench System will allow materials science studies of undercooled materials and new materials development. In this presentation, the system is described and initial results are presented.